**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**
**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In Re Application of:

Tieyu Zheng — Examiner: Marcia A. Golub

Application No.: 10/ 805,824 — Art Unit: 2828

Filed: March 22, 2004 — Confirmation No: 1482

For: AN OPTOELECTRONIC MODULE WITH INTEGRATED COOLER

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

## APPEAL BRIEF UNDER 37 C.F.R. § 41.37(a)

This is an appeal to the Board of Patent Appeals and Interferences from the decision of the Examiner of Group 2828, dated January 23, 2008, which finally rejected Claims 25, 26, 28, 29, 31-34 and 36-47 in the above-identified application. The Office's date of receipt of Appellant's Notice of Appeal was July 25, 2008. This Appeal Brief is hereby submitted pursuant to 37 C.F.R. § 41.37(a).

(14) **CERTIFICATE OF ELECTRONIC FILING**

I hereby certify that this correspondence is being deposited with the United States Patent and Trademark Office via electronic filing through the United States Patent and Trademark Electronic Filing System on: September 23, 2008.
Date of Deposit

Teresa Mattox
Name of Person Filing Correspondence

Teresa Mattox — September 23, 2008
Signature — Date

## TABLE OF CONTENTS

## 1. REAL PARTY IN INTEREST

1.1 The real party in interest and assignee of record is Intel Corporation, a corporation of Delaware having the principal place of business at 2200 Mission College Boulevard, Santa Clara, California 95052.

## 2. RELATED APPEALS AND INTERFERENCES

2.1 To the best of Appellant's knowledge, there are no appeals or interferences related to the present appeal that will directly affect, be directly affected by, or have a bearing on the Board's decision in the instant appeal.

## 3. STATUS OF THE CLAIMS

3.1 Claims 25, 26, 28, 29, 31-34 and 36-47 are pending in the present application. Dependent claims 26, 28, 29, 31-34 and 36-47 are dependent upon independent claim 25.

3.2 Claims 1-24, 27, 30 and 35 have been canceled.

3.3 Claims 25, 26, 28, 29, 31-34 and 36-47 stand finally rejected under 35 U.S.C. 103(a) in an Office Action mailed January 23, 2008.

3.4 Claims 25, 26, 28, 29, 31-34 and 36-47 are the subject of this appeal. A copy of Claims 25, 26, 28, 29, 31-34 and 36-47 as they stand on appeal is set forth in Appendix A.

## 4. STATUS OF AMENDMENTS

4.1 No amendments have been submitted subsequent to the Final Office Action mailed January 23, 2008.

## 5. SUMMARY OF CLAIMED SUBJECT MATTER

5.1 This section of this Appeal Brief is set forth to comply with the requirements of 37 C.F.R. 41.37(c)(1)(v) and is not intended to limit the scope of the claims in any way. Exemplary implementations of the limitations of independent claim 25 are described below.

5.2 Appellant's invention, as claimed in claims 25, 26, 28, 29, 31-34 and 36-47, is directed to an optoelectronic module for communication purpose (*paragraph [0015] of Specification*). Independent claim 25 is the only independent claim involved in this appeal.

5.3 Claim 25 relates to an optoelectronic module of which an embodiment is illustrated in FIG. 1 and amended FIG. 2 of Drawings. The optoelectronic module includes substrate 112, thermo-electric cooler 110, laser light source 102, laser light control device 104 and electrical connection 105 (connecting laser light source 102 and laser light control device 104) (*see FIG. 1 and amended FIG. 2 of Drawings*). Substrate 112 defines a stepped upper surface having a lower portion and an upper portion (*see paragraph [0019] lines 6-7 of Specification; FIG. 2 and FIG. 3 of Drawings*). Thermo-electric cooler 110 is disposed on the lower portion of

the substrate 112 (*see paragraph [0020] lines 1-2 of Specification; FIG. 1 and amended FIG. 2 of Drawings*). Thermo-electric cooler 110 includes a top portion 310 having flat top surface 311 (*see amended paragraph [0018] lines 9-10 of Specification; amended FIG. 3a of Drawings*). Laser light source 102 is disposed on flat top surface 311 of top portion 310 of the thermo-electric cooler 110 (*see amended paragraph [0018] lines 13-14 of Specification; amended FIG. 2 of Drawings*). Laser light source 102 is thermally coupled to thermo-electric cooler 110 to cool laser light source 102 (*see paragraph [0015] lines 4-5 of Specification; FIG.1 and amended FIG. 2 of Drawings*). **Laser light control device 104 is disposed on the upper portion of the stepped surface of substrate 112** (*see amended paragraph [0020] lines 1-4, 9-11 of Specification; FIG. 1 and amended FIG. 2 of Drawings*). Laser light control device 104 and laser light source 102 are electrically coupled by way of electrical connection 105 (*see amended paragraph [0020] lines 8-10 of Specification; amended FIG. 2 of Drawings*).

## 6. GROUNDS OF REJECTIONS TO BE REVIEWED ON APPPEAL

Whether Claims 25, 26, 28-29, 33-34, 41-45 are unpatentable under 35 U.S.C. 103(a) over Yamauchi et al. (U.S. 2001/0033592) (hereinafter "*Yamauchi*") in view of Malone et al. (U.S. 6,888,169) (hereinafter "*Malone*");

## 7. ARGUMENT

Rejection under 35 U.S.C. 103(a) over *Yamauchi* (U.S. 2001/0033592) in view of *Malone* (U.S. 6,888,169)

Claims 25, 26, 28-29, 33-34, 41-45

7.1 It is Appellant's understanding that the subject matter of independent Claim 25 is not rendered obvious under 35 U.S.C. 103(a) over *Yamauchi* in view of *Malone*. Appellant submits that one of ordinary skill in the art would not combine the teachings of *Yamauchi* and *Malone*.

7.2 Claim 25 claims:

"*An optoelectronic module comprising:*

.....

*a laser light control device disposed on the upper portion of the stepped surface of the substrate*" (emphasis added).

7.3 The Examiner claimed (on page 4 of the Final Office Action mailed on January 23, 2008) that:

> "one of ordinary skill in the art would be motivated to incorporate the teaching of *Malone* into the device of *Yamauchi* by **placing the laser driver[1] on the upper surface of the substrate** in order to position the laser driver closer to laser diode 1 and **reduce noise associated with long wires**" (emphasis added).

7.4 The Examiner agreed that (on page 6 of the Final Office Action mailed on September 21, 2007) *Yamauchi* discloses placing control circuit 21 **outside** package body 2 (see FIG. 5A of *Yamauchi*) but fails to disclose placing control circuit 21 **inside** package body 2. The Examiner purported that it is well known that longer wires introduce noise and instability and cited *Malone* as evidence of placing a laser driver inside an optical package, hence the 35 U.S.C. 103(a) rejection.

7.5 Appellant respectively submits that the Examiner has erred in rejecting Claim 25. Specifically, Appellant contends that:

(A) The proposed modification of *Yamauchi* would render *Yamauchi* unsatisfactory for its intended purpose;

(B) The Examiner's arguments in support of the proposed modification are flawed; and

(C) The Examiner has improperly relied on common knowledge.

The proposed modification of *Yamauchi* would render *Yamauchi* unsatisfactory for its intended purpose

7.6 "If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no

[1] i.e. The corresponding "control circuit 21" as illustrated in FIGS. 5A and 5B in *Yamauchi* and the "laser light control device" in Claim 25.

suggestion or motivation to make the proposed modification"- MPEP ¶ 2143.01 (V).

7.7 The purpose of *Yamauchi* is to overcome an erroneous operation of a known wavelength locker. FIG. 1 of *Yamauchi* illustrates optical module 10 having a conventional wavelength locker. A wavelength locker is a temperature regulation mechanism for maintaining the desired oscillation wavelength of the output beam of an optical module. For example, when there is a rise of operational temperature of laser diode 1, the oscillation wavelength of the output beam of laser diode 1 will shift to a longer wavelength. Second optical beam 1B passing through optical filter 6 will have a lower optical power and will be detected by photodiode 7 indicating an increase of operational temperature of laser diode 1. The control circuit will be activated to cool temperature regulation block 3 in order to reduce the operational temperature of laser diode 1 and hence shifting the oscillation wavelength of laser diode 1 back to the desired lower wavelength (see paragraph [0015] in *Yamauchi*).

7.8 Errors may occur in the above-described known wavelength locker when, for example, there is a temperature difference between laser diode 1 and optical filter 6 as a result of temperature rise of the environment in which optical module 10 is placed (see paragraph [0018] in *Yamauchi*). Laser diode 1 is temperature-controlled by control circuit whereas optical filter 6 is not. Therefore, changes in the environment temperature would affect laser diode 1 differently from optical filter 6 as. In such a case, there may

be an imbalance of temperature between laser diode 1 and optical filter 6. For example, when the environment temperature rises, the temperature of optical filter 6 may be higher than the temperature of laser diode 1 (the temperature of laser diode 1 may be properly controlled by temperature regulation block 3). The control circuit may erroneously judge that the temperature of laser diode 1 as having decreased and then erroneously activate temperature regulation block 3 to raise the temperature of laser diode 1. By raising the operational temperature of laser diode 1, the oscillation wavelength of output beam 1A of laser diode 1 is shifted from the desired wavelength to a longer wavelength (see paragraph [0021] in *Yamauchi*).

7.9 *Yamauchi* attempts to solve the erroneous wavelength locker by balancing any temperature difference between optical filter 6 and laser diode 1. *Yamauchi* provides an intentional thermal coupling by way of bonding wires 9 between the environment outside optical module 20 and laser diode 1 (see FIGS. 5A and 5B and paragraph [0048] in *Yamauchi*). When the environment temperature rises, the transmittance curve of optical filter 6 will shift to a longer wavelength (see paragraph [0053] and FIG. 6A in *Yamauchi*). Heat from the environment will be transferred to laser diode 1 via bonding wires 9 and will cause a corresponding rise in the temperature of laser diode 1 (see paragraph [0054] in *Yamauchi*). Meanwhile, the oscillation wavelength of laser diode 1 will shift to longer wavelength and result in optical beam 1B having a lower optical power (see paragraph [0055] in *Yamauchi*). The decrease in optical power of optical beam 1B

will be detected by photodiode 7 and control circuit 21 will be activated to cool laser diode 1 and to shift the oscillation wavelength to desired wavelength. Thus, bonding wires 9 establish a temperature balance between laser diode 1 and optical filter 6 in terms of how the change in environment temperature affects both laser diode 1 and optical filter 6 (see paragraph [0059] in *Yamauchi*).

7.10 Modifying *Yamauchi* to include control circuit 21 inside package body 2 of optical module 20 would render *Yamauchi* unsatisfactory for its intended purpose. It is well known that circuits generate heat. Placing control circuit 21 at the very interior of optical module 20 would destroy the purpose of balancing the temperatures between laser diode 1 and optical filter 6. Heat from control circuit 21 will raise the temperature of optical filter 6 and result in first photodiode 7 detecting a decreased optical power of optical beam 1B. Control circuit 21 will erroneously judge that the temperature of laser diode 1 has decreased and will then erroneously activate temperature regulation block 3 to raise the temperature of laser diode 1 (although the temperature of laser diode 1 may be properly controlled by temperature regulation block 3). Such is the error present in conventional temperature regulation mechanism (called wavelength locker) for optical modules which *Yamauchi* intends to resolve. While bonding wires 9 are capable of transferring heat from the environment to laser diode 1, bonding wires 9 are incapable of addressing the additional temperature disturbances caused by the heat generated by control circuit 21 within

optical module 20. Hence, the intended purpose of *Yamauchi* will be defeated if the proposed modification is implemented.

*The Examiner's arguments in support of the proposed modification are flawed*

7.11 The Examiner argues on page 2 of the Final Office Action mailed on January 23, 2008, in rebuttal of Appellant's arguments that *Yamauchi*'s device would be destroyed, the following points:

(a) a thermo-electric cooler (TEC) can be placed underneath control circuit 21 to reduce the heat; and

(b) raising the temperature inside optical module 20 by adding a circuit will not affect laser diode 1 and optical filter 6 disproportionately since *Yamauchi* provides for installing a desired number of bonding wires 9 based on the temperature requirement.

7.12 In relation to placing a TEC underneath control circuit 21, Appellant submits that Claim 25 claims "a laser light control device disposed on the upper portion of the stepped surface of the substrate". It follows that in order for *Yamauchi* to render Claim 25 obvious, control circuit 21 must be placed on "an upper portion of a stepped surface of package body 2" and not "on temperature regulation block 3". Further, *Yamauchi* explicitly teaches away having two separate temperature regulation blocks 3 in optical module 20 as such configuration involves complex construction and increased power consumption (see paragraph [0022] in *Yamauchi*).

Therefore, the proposition that control circuit 21 may be placed on a thermo-electric cooler (TEC) to reduce the heat generated by control circuit 21 is taught away by *Yamauchi* itself.

7.13 In relation to the Examiner's argument that raising the temperature inside optical module 20 will not affect laser diode 1 and optical filter 6 disproportionately, the Examiner supports that proposition by arguing that *Yamauchi* provides for installing a number of bonding wires 9 based on the temperature requirement. Curiously, the Examiner has not explained how bonding wires 9 will not affect laser diode 1 and optical filter 6 when the temperature inside optical module 20 is raised.

7.14 Appellant respectfully submits that the Examiner has misinterpreted the function and operation of bonding wires 9 as well as has ignored the teaching in *Yamauchi* against introducing heat into the package body 2 other than from the environment via bonding wires 9. *Yamauchi* disclosed that the device will not function properly anymore when excessive amount of heat is transferred from the environment via bonding wires 9 to optical module 20 (see paragraph [0063]). Placing heat-generating control circuit 21 in the very heart of optical module 20 is tantamount to transferring heat from the environment to optical module 20. The excessive amount heat will shift the operational point of the optical filter 6 on a sinusoidal transmittance curve (see FIG. 8) from region A to region B (see paragraph [0063] in *Yamauchi*). The number of bonding wires 9 is a design factor of the wavelength locker determining the desired range of heat transfer

between the environment and package body 2 (see paragraph [0059] in *Yamauchi*).

7.15 *Yamauchi*'s device expressly incorporated features to minimize heat transfer from the environment into optical module 20 other than via bonding wires 9. *Yamauchi* suggested the space within optical module 20 to be in a vacuum or in a reduced pressure state to be filled with a gas of low thermal conductivity such as $N_2$ or Ar. Such configuration is aimed to retard the penetration of heat from outside of optical module 20 into optical module 20 (see paragraph [0065] in *Yamauchi*). *Yamauchi* further suggested that optical filter 6 to include an $SiO_2$ or resin film to minimize the transfer of environmental heat via radiation (see paragraph [0067] in *Yamauchi*). The proposed modification of placing a heat-generating circuit inside optical module 20 would clearly go against the teaching of *Yamauchi* and render *Yamauchi* unsatisfactory for its intended purpose.

The Examiner has improperly relied on common knowledge

7.16 The Examiner argued on page 6 of the Final Office Action mailed on September 21, 2007 that it is well known that longer wires introduce noise and instability into the system. Therefore, one of ordinary skill in the art would be motivated to place control circuit 21 inside optical module 20. The Examiner cited *Malone* as evidence of suggestion to place laser diode drivers in an optical module.

7.17 Appellant submits that the Examiner has improperly relied on a common knowledge without considering the subject matter of the cited references as a whole. Firstly, *Yamauchi* does not indicate any concern on signal integrity of connections between control circuit 21 and components of optical module. In fact, Appellant wonders how the proposed modification would improve the operability of *Yamauchi* other than rendering Yamauchi unsatisfactory for its intended purpose. The concern *Yamauchi* disclosed relates to heat, specifically heat from the environment being transferred via radiation into optical module. Heat is a concern in *Yamauchi* as heat affects the temperature of the components inside optical module 20 and the operating wavelength of optical beam. On the other hand, one of ordinary skill in the art, based on common knowledge as well as teachings in *Yamauchi*, would appreciate that placing heat-generating control circuit 21 inside optical module would render *Yamauchi* unsatisfactory for its intended purpose as elaborated in above paragraphs. *Malone* relates to the packaging of optical components in an optoelectronic module. *Malone* does not share the grave concern of heat transfer from the environment into an optical module as present in *Yamauchi*. Unlike *Yamauchi*, *Malone* does not concern solving an erroneous wavelength locker. Nor does *Malone* suggest placing electrical components closely to avoid introducing noise and instability to the optoelectronic system. Hence, appellant respectfully submits that the very basis of application of common knowledge in the art to *Yamauchi* is improper.

7.18 On the other hand, one of ordinary skill in the art would appreciate that components of a circuit generate noises and placing control circuit 21 inside optical module 20 would probably affect components in optical module 20. For example, thermister 4A is susceptible of picking up noises as it generally made from high impedance material. One of ordinary skill in the art would, before deciding to place control circuit 21 inside optical module 20, consider the effect of noises from circuit on the operation of thermister 4A. Appellant respectfully submits that in that circumstance, one of ordinary skill in the art would not be motivated to adopt the proposed modification suggested by the Examiner.

## 8. CONCLUSION

8.1 For the reasons stated above, rejection of Claims 25, 26, 28, 29, 31-34 and 36-47 under 35 U.S.C. 103(a) over *Yamauchi* in view of *Malone* cannot be sustained. Appellant respectfully requests the Board to reverse the rejections of Claims 25, 26, 28, 29, 31-34 and 36-47 under U.S.C. § 103(a) and direct the Examiner to enter a Notice of Allowance for Claims 25, 26, 28, 29, 31-34 and 36-47.

**Fee For Filing A Brief In Support Of Appeal**

Enclosed is a check in the amount of $500.00 to cover the fee for filing a brief in support of an appeal as required under 37 C.F.R. 1.17(c) and 40.20(b)(2). (If a check is not enclosed, you are hereby authorized to charge the deposit account below).

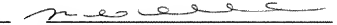
**Deposit Account Authorization**

Authorization is herby given to charge our Deposit Account No. 02-2666 for any charges that may be due. Furthermore, if an extension is required, then Appellant hereby requests such extension.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Date: September 23, 2008



Michael A. Bernadicou
Reg. No. 35,934

1279 Oakmead Parkway
Sunnyvale, CA 94085-4040
(408) 720-8300

## APPENDIX A : CLAIMS

25. An optoelectronic module comprising:

a substrate defining a stepped upper surface having a lower and an upper portion, the substrate being configured such that a lower surface thereof determines a footprint of the module;

a thermo-electric cooler disposed on the substrate and having a top portion including a flat top surface, the flat top surface making an entire top surface of the top portion and being substantially parallel to the lower surface of the substrate, the thermo-electric cooler further being disposed on the lower portion of the stepped surface;

a laser light source disposed on the flat top surface of the top portion of the thermo-electric cooler such that the thermo-electric cooler is disposed between the substrate and the laser light source, wherein the thermo-electric cooler is further thermally coupled to the laser light source to cool the laser light source;

an electrical connection extending from the upper portion of the upper surface of the substrate to the laser light source; and

a laser light control device disposed on the upper portion of the stepped surface of the substrate, the electrical connection electrically coupling the laser light control device to the laser light source.

26. The module of claim 25, further comprising a structure defining an enclosed environment and including the substrate, wherein:

the substrate is at least partially disposed in the enclosed environment; and

the thermo-electric cooler, the laser light source and the electrical connection are disposed in the enclosed environment.

28. The module of claim 25, wherein the laser light control device includes at least one of a driver and an amplifier.

29. The module of claim 25, wherein the thermo-electric cooler includes a plurality of elongated thermo-electric elements and a bottom portion, the thermo-electric elements being disposed substantially in parallel between the top portion and the bottom portion of the thermo-electric cooler, the top planar surface being substantially orthogonal to the thermo-electric elements.

31. The module of claim 25, wherein the laser light source is disposed directly on the thermo-electric cooler.

32. The module of claim 25, wherein the substrate includes a substrate body and plurality of vias extending through the substrate body, the vias being electrically connected by way of the substrate body to the thermo-electric cooler and adapted to dissipate thermoelectricity from the thermo-electric cooler.

33. The module of claim 25, wherein the thermo-electric cooler and the upper portion of the stepped surface are disposed such that the upper portion is substantially co-planar with the flat top surface of the thermo-electric cooler.

34. The module of claim 25, wherein the substrate includes a substrate body comprising a one-piece component.

36. The module of claim 25, wherein the substrate includes a substrate body and a plurality of vias extending through the substrate body, the vias being electrically connected by way of the substrate body to the laser light control device.

37. The module of claim 25, wherein the laser light source emits light bundles in a direction substantially parallel with a top surface of the thermo-electric cooler, the module further including an optical device disposed on the substrate and adapted to redirect the light bundles from the direction substantially parallel with the top surface of the thermo-electric cooler to a direction that is substantially orthogonal to the top surface of the thermo-electric cooler.

38. The module of claim 37, wherein the optical device includes at least one of a mirror assembly and prisms.

39. The module of claim 37, wherein the optical device is disposed on the thermo-electric cooler.

40. The module of claim 25, wherein the substrate includes a ceramic material.

41. The module of claim 25, wherein the thermo-electric cooler comprises a T-shaped bottom portion.

42. The module of claim 25, wherein the laser light source comprises one of a vertical cavity surface-emitting laser device, a Fabry-Perot laser device, a distributed feedback laser device, and a laser diode device.

43. The module of claim 26, further including a cap partially defining the enclosed environment, the cap being disposed on the substrate.

44. The module of claim 43, further comprising an overhanged ring disposed on a perimeter of the substrate and supporting the cap thereon.

45. The module of claim 43, wherein the cap includes an optical window adapted to facilitate an exit of laser light bundles from the enclosed space.

46. The module of claim 45, wherein the optical window includes one of a flat glass window, a ball lens, an aspherical lens, and a GRIN lens.

47. The module of claim 26, further comprising a laser light control device disposed on the upper portion of the stepped surface of the substrate and in the enclosed environment, the electrical connection electrically coupling the laser light control device to the laser light source, wherein:

the substrate includes a substrate body and:

a plurality of first vias extending through the substrate body, the first vias being electrically connected by way of the substrate body to the thermo-electric cooler and adapted to dissipate thermoelectricity from the thermo-electric cooler; and

a plurality of second vias extending through the substrate body, the second vias being electrically connected by way of the substrate body to the laser light control device.

## APPENDIX B: EVIDENCE

NONE

## APPENDIX C: RELATED PROCEEDINGS

NONE